1. A method for forming an electrode, comprising:

combining a platinum precursor with a gold precursor to form an electrode ink;

forming the electrode ink into an electrode precursor;

firing the electrode precursor to form the electrode;

treating the electrode in an environment having an oxygen partial pressure of less than or equal to 500 ppm oxygen for a period of time sufficient produce an electrode with an exposed surface gold concentration of greater than or equal to about 6 times a bulk gold concentration in the electrode.

2. The method of Claim 1, wherein the surface gold concentration is greater than or equal to about 5 wt% based upon the total weight of the Pt-Au alloy at the surface of the electrode.

3. The method of Claim 2, wherein the surface gold concentration is about 5 wt% to about 25 wt% based upon the total weight of the Pt-Au alloy at the surface of the electrode.

4. The method of Claim 1, wherein the electrode is treated at a temperature of about 550°C to about 1,000°C and the period of time is about 0.5 hrs to about 10 hrs.

5. The method of Claim 1, wherein the bulk gold concentration is about 0.1 wt% to about 2.0 wt% of the total weight of the Pt-Au alloy in the electrode.

6. The method of Claim 5, wherein the bulk gold concentration is about 0.2 wt% to about 1.0 wt% of the total weight of the Pt-Au alloy in the electrode.

7. The method of Claim 1, wherein the electrode ink comprises about 43 wt% to about 62 wt% platinum, about 0.05 wt% to about 1 wt% gold, and about 38 wt% to about 48 wt% fugitive material, based upon the total weight of solids in the electrode ink.

8. The method of Claim 7, wherein the electrode ink further comprises about 2 to about 8 wt% oxides, based upon the total weight of the solids in the electrode ink.

9. The method of Claim 8, wherein the electrode ink comprises about 45 wt% to about 56 wt% platinum, about 0.1 wt% to about 0.7 wt% gold, about 40 wt% to about 48 wt% fugitive material, about 4 to about 7 wt% oxide, based upon the total weight of the solids in the electrode ink.

10. The method of Claim 1, wherein the surface gold concentration is extends a thickness of less than or equal to about 400 nanometers into the electrode.

11. The method of Claim 10, wherein the surface gold concentration is extends a thickness of about 100 to about 300 nanometers into the electrode.

12. The method of Claim 11, wherein the electrode has an electrode thickness of about 4 to about 20 micrometers.

13. An electrode produced by the process of Claim 1.

14. A platinum-gold alloy electrode comprising:

a bulk gold concentration of about 0.2 wt% to about 1.0 wt%, based upon the total weight of the Pt-Au alloy in the bulk of the electrode; and

an exposed surface gold concentration of about 5 wt% to about 25 wt%, based upon the total weight of the Pt-Au alloy at the surface of the electrode;

wherein the surface gold concentration extends about 50 nm to about 400 nm into the electrode.

15. The platinum-gold alloy electrode of Claim 14, wherein the surface gold concentration extends about 150 nm to about 300 nm into the electrode.

16. The platinum-gold alloy electrode of Claim 14, wherein the exposed surface gold concentration is about 8 wt% to about 20 wt%, based upon the total weight of the Pt-Au alloy at the surface of the electrode.

17. The platinum-gold alloy electrode of Claim 14, wherein the exposed surface gold concentration is about 10 wt% to about 15 wt%, based upon the total weight of the Pt-Au alloy at the surface of the electrode.

18. A sensor, comprising:

a cell comprising a first electrode and a second electrode, and a first electrolyte layer disposed between the first electrode and the second electrode, wherein the first electrode is a platinum-gold alloy electrode having a surface opposite the first electrolyte having a surface gold concentration greater than a bulk gold concentration; and

a heater disposed on a side of the second electrode opposite the first electrolyte and in thermal communication with the first cell.

19. The sensor of Claim 18, wherein the surface gold concentration is about 8 wt% to about 20 wt%, based upon the total weight of the platinum-gold alloy at the surface.

20. The sensor of Claim 19, wherein the surface gold concentration is about 10 wt% to about 15 wt%, based upon the total weight of the platinum-gold alloy at the surface.

21. The sensor of Claim 18, further comprising an emf cell in operable communication with the first cell and between the first cell and the heater, wherein the emf cell comprises a sensing electrode and a reference electrode, and a second electrolyte layer disposed between the sensing electrode and the reference electrode; and

an insulation layer disposed between the first cell and the emf cell.